

REMARKS

The application has been reviewed in light of the Office Action dated August 1, 2003. Claims 1-58 are pending in the application, with claims 7-10, 19-21 and 28-58 having been withdrawn by the Patent Office from consideration. Claims 11-18 have been allowed.

By the present Amendment, Applicants have amended claims 5 and 23-27, to place the application in better form for examination and to clarify the claimed invention. Accordingly, claims 1-6 and 22-27 are presented for examination, with claims 1, 2 and 22 being in independent form. It is submitted that no new matter has been added by the present amendment.

Claims 5 and 23-27 were rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Claims 5 and 24-27 were rejected under 35 U.S.C. §101 as purportedly directed to non-statutory subject matter.

In response, the claims have been amended to clarify the claimed invention and place the application in better form for examination, without narrowing the scope of the claimed invention. Accordingly, withdrawal of the rejection under 35 U.S.C. §112, second paragraph, and rejection under 35 U.S.C. §101 are respectfully requested.

Claims 1-4, 6, 22 and 23 were rejected under 37 U.S.C. §103(a) as allegedly unpatentable over Gavrilin et al. (Perspektivnye Materialy Vol. 1999, No. 2, pp. 22-25, 1999, in Russian).

Applicants have carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claims 1, 2 and 22 are patentable over the cited art, for at least the following reasons.

This application relates to growing crystals of a group-III nitride using a nitrogen material and a mixed molten liquid which comprises an alkaline metal and a substance which includes a group-III metal. A liquid holding vessel (such as a reaction vessel) is provided to contain the mixed molten liquid and prevent the alkaline metal vapor from dispersing out of the vessel. Thereby, evaporation of the alkaline metal out of the reaction vessel and condensation thereof can be prevented and it becomes possible to avoid obstruction against supply of the nitrogen material, and thus change of material composition. Consequently, the crystal growth can be well controlled and satisfactory group-III nitride crystals can be grown stably and having a sufficient size, such that, for example, a semiconductor device such as a high-efficiency light emitting diode can be produced.

For example, independent claim 1 relates to a crystal growth method. A nitrogen material is supplied into a reaction vessel containing a mixed molten liquid comprising an alkaline metal and a group-III metal. A crystal of a group-III nitride is grown using the mixed molten liquid and the nitrogen material in the reaction vessel. A provision is made such as to cause a vapor of the alkaline metal to stay inside said reaction vessel.

Gavrillin, as understood by Applicants, relates to liquid phase gallium nitride epitaxy from gallium-lithium melts. According to Gavrillin, its methodology was used to obtain islet growth of GaN on a substrate and spontaneous nucleation of crystals on the surface of the substrate.

Applicants finds no disclosure or suggestion in Gavrillin, however, that a reaction vessel is or should be used to cause vapors of the alkaline metal to stay inside the reaction vessel. Indeed, the

Office Action tacitly acknowledges that there is no such disclosure or teaching in Gavrilin.

However, the Office Action alleges that it would have been obvious to modify the methodology of Gavrilin to contain the alkaline metal because containment purportedly would have kept growth parameters constant which, according to the Office Action, is demonstrated in Figs. 1-3. Applicants respectfully disagree.

Fig. 1 of Gavrilin show electron microscope snapshots of a process for liquid-phase epitaxy on a substrate. Figs. 2 and 3 show plots of intensity versus energy and intensity versus wavelength, respectively, obtained with GaN grown from lithium-gallium melts according to the methodology of Gavrilin. None of Figs. 1-3 of Gavrilin discloses or suggests that a reaction vessel is or should be used to cause vapors of the alkaline metal to stay inside the reaction vessel.

Gavrilin simply does not provide motivation for modifying its methodology to use a reaction vessel to cause vapors of the alkaline metal to stay inside the reaction vessel, unless the claims of this application are impermissibly used in hindsight as a roadmap to reconstruct the claimed invention.

As another difference from the cited art, Applicants find no teaching or suggestion in Gavrilin to control the concentration distribution of nitrogen, or to control the shape of the vessel. According to the present application, for a purpose of obtaining a stable growth of high quality and large sized group III nitride crystal, as claimed in claims 22-27, a local nitrogen concentration distribution is created in a mixed molten liquid, or the shape of the vessel is controlled, so as to achieve a growth of a larger crystal. As such a feature is neither disclosed nor suggested by the cited art,

the claimed invention would not have been obvious therefrom.

Since the cited art does not disclose or suggest each and every feature of the claimed invention, the cited art does not render the claimed invention unpatentable.

Independent claims 2 and 22 are patentably distinct from the cited art for at least similar reasons.

Accordingly, for at least the above-stated reasons, Applicants respectfully submit that independent claims 1, 2 and 22, and the claims depending therefrom, are patentable over the cited references.


If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition, and the Commissioner is authorized to charge the requisite fees to our Deposit Account No. 03-3125.

The Office is hereby authorized to charge any fees that may be required in connection with this response, and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Reconsideration and allowance of this application are respectfully requested.

Respectfully submitted,



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